



Peñuelas Technology Park, LLC

Basis for the Selection of the Corrective Measure for SWMU No. 5

Final

September 2019

The Dow Chemical Company



Peñuelas Technology Park, LLC

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Acronyms and Abbreviations

BERA	Baseline Ecological Risk Assessment
CFR	Code of Federal Regulations
CM	Corrective Measures
CMS	Corrective Measures Study
CORCO	Commonwealth Oil Refining Corporation
CWC	Cooling Water Canal
Dow	The Dow Chemical Company
ft ²	square feet
HDPE	high-density polyethylene
Module III	Corrective Action Module
PAH	polycyclic aromatic hydrocarbon
PTPLLC	Peñuelas Technology Park, LLC
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment
RFI	RCRA Facility Investigation
SWMU	Solid Waste Management Unit
UCC	Union Carbide Corporation
UCCLLC	Union Carbide Caribe, LLC
USC	United States Code
USEPA	U.S. Environmental Protection Agency
yd ³	cubic yards

1. Introduction

Peñuelas Technology Park, LLC (PTPLLC), a wholly owned subsidiary of The Dow Chemical Company (Dow), is requesting that the Corrective Action Module (Module III) of its Resource Conservation and Recovery Act (RCRA) Part B permit be modified to include the proposed remedy for Solid Waste Management Unit Number 5 (SWMU No. 5), the Cooling Water Canal (CWC) at its facility located in Peñuelas, Puerto Rico. The proposed remedy consists of placing an engineered cap over contaminated sediment in the northern end of the canal.

Corrective action is governed in the RCRA Part B permit by Section 3004(u) of RCRA, Title 42 U.S. Code (USC) Section 6924(u). Implementation of corrective action generally includes three phases: the RCRA Facility Assessment (RFA), the RCRA Facility Investigation (RFI), and Corrective Measures (CM). SWMU No. 5 was identified in the facility RFA (completed in 1986 and amended in 1988) and listed in the Facility Operating Permit issued in 1988 (USEPA 2003). The permit required that the sediments in the CWC be further investigated and corrective actions implemented if needed.

In accordance with the requirements in Title 40 of the Code of Federal Regulations (CFR) Part 270.42, a 60-day public comment period on this action is being provided. The proposed remedy may be revised based on comments received during this period.

2. Facility Background

2.1 Site History

PTPLLC operated a petrochemical manufacturing plant on the site from 1959 through 1985; the plant has since been decommissioned. Over the past 20 years, nearly all of the buildings, plant process equipment, and utility infrastructure systems on the plant site have been removed, demolished, or abandoned in place (CH2M HILL 2015).

The PTPLLC facility occupies approximately 633 acres of low-lying land along the southern coast of Puerto Rico (CH2M HILL 2015). As shown in Figure 1, the facility is bounded to the north and west by the Commonwealth Oil Refining Corporation (CORCO) bulk fuel terminal, to the south by Tallaboa Bay of the Caribbean Sea, and to the east by the Tallaboa River.

The PTPLLC facility is comprised of two main areas: the Main Plant Area and the Puntilla Area. The Main Plant Area is where the former petrochemical manufacturing facility was located, which has since been demolished and dismantled. The CWC is located along the west side of the Main Plant Area (CH2M HILL 2015).

2.2 Site Geology

The CWC lies in an area where sediment materials were found to be predominantly organic clays overlying a thin layer of silty sands overlying limestone. The material was primarily classified as silty clay, except near the southern end of the canal, where the sediments were silty sands, or highly organic clays and silts (CH2M HILL 2014a).

3. Summary of Environmental History

3.1 Cooling Water Canal Background

The CWC is a constructed open channel, running along the west side of the former manufacturing area of the PTPLLC site and exiting to Tallaboa Bay to the south (CH2M HILL 2015). Figure 2 shows the SWMU No. 5 project location and layout. The CWC banks are nearly vertical, approximately 2 to 5 feet high, and vegetated with mangroves along most of their length, except in the southern portion in which the bank is seawall, boulders, or other constructed surfaces. The CWC is approximately 3,000 feet long and ranges

in width from approximately 50 feet at the northern end to more than 300 feet at the southern end. Water depth normally ranges from less than 3 feet at the northern end to approximately 16 feet at the southern end. Seasonal precipitation and tidal fluctuations control the direction and rate of flow in the CWC. A paved vehicle bridge crosses the canal approximately 400 feet south of the northern end, and a pipe rack bridge crosses the canal approximately 800 feet north of the southern end. The site topography in the vicinity is flat with little relief, with land surface elevations typically less than 10 feet above mean sea level. Landside access to the CWC is via a paved road along the eastern bank, and a vehicle bridge near the northern end (CH2M HILL 2015).

The CWC is hydraulically downgradient of the Industrial Landfill Area and has sustained impacts from former dripolene disposal operations. Investigations to assess the nature and extent of dripolene-related impacts to CWC sediments were conducted from 1977 through 2013 (UCC 2000; UCC 2001).

3.2 Baseline Ecological Risk Assessment

A Baseline Ecological Risk Assessment (BERA) was conducted at the CWC in 2005 to evaluate the potential risk of sediment constituents to ecological receptors at the site. The BERA concluded that direct contact with sediments represents the exposure pathway of greatest concern. The polycyclic aromatic hydrocarbon (PAH) concentrations in surface sediments at the northern end of the canal were several times greater than concentrations shown in the literature to produce adverse effects in benthic organisms. In addition, even though the risk cannot be precisely quantified, manatees (a federally endangered species) resting on PAH-contaminated sediment may be at risk of increased incidence of lesions and other dermal effects. The risk evaluation found no elevated risk from exposure to surface water or ingestion of food by fish, birds, or marine mammals. The concentrations observed in the southern portion and canal mouth were generally below the range associated with elevated risk to benthic organisms (CH2M HILL 2006).

3.3 RCRA Facility Investigation

Phase I RFI, conducted by Union Carbide Caribe, LLC (UCCLLC) in 2000, confirmed the presence of several site-related chemicals in CWC sediment, reporting the highest levels in the northern half of the canal and levels decreasing toward the canal mouth. Focused sampling of canal sediment and surface water in 2000 indicated that all analyzed surface water parameters were below detection limits (UCC 2000).

A focused RFI was conducted in 2007, to gather additional data to more accurately delineate the extent of sediment constituents, determine sediment depth and geotechnical properties, conduct a mangrove survey along the canal banks, and obtain bathymetric data. Samples were collected from the vehicle bridge to the mouth of the canal. Field activities were initiated on August 14, 2007, and completed on September 20, 2007. The objective of this RFI was to complete the data collection needed for the identification and development of appropriate corrective measures (CH2M HILL 2008a).

The draft RFI Report was submitted to the U.S. Environmental Protection Agency (USEPA) in January 2008 and concluded that the focused RFI sampling results were generally consistent with results obtained in the 2000 Phase I RFI and the 2005 BERA. Specifically, the concentrations of dripolene-related constituents are generally highest in the upper 2,000 feet of the CWC, with surface sediment constituent concentrations at levels posing potential risk to benthic invertebrates. Sediment properties are characteristic of fine-grained alluvial deposits and, based on the limited data obtained, sediment strengths are low (CH2M HILL 2008a).

4. Corrective Measure Alternatives

The corrective action objectives targeted include preventing downgradient migration of impacted sediment, minimizing net impact of shoreline mangrove vegetation, promoting the growth and diversity of post-remedy benthic communities, and maintaining surface drainage of the surrounding lands. Selecting an alternative that meets these objectives will allow for successful achievement of cleanup goals (CH2M HILL 2015).

The specific cleanup goal is to minimize or block the contact of ecological receptors with impacted sediments in the upper canal, and to control the migration of highly contaminated sediments within the upper canal. The remedial goal for subsurface sediments in the lower canal is to prohibit activities that could result in future migration of subsurface contaminated sediment to surface sediments or other water bodies (CH2M HILL 2015).

The Corrective Measures Study (CMS) work plan was submitted to USEPA in February 2015, and the final CMS was approved by USEPA on June 27, 2018. The following remedial alternatives were considered for the corrective action:

4.1 Alternative 1: No Action

Alternative 1 is the No Action alternative, for which no remedial activities would be performed. This includes no monitoring and no further institutional or engineering controls. The site would essentially be abandoned. This approach would not meet any screening criteria requirements for sediment; benthic organism in the upper canal sediments would be exposed to high concentrations of PAHs and dipolene product; these sediments would be susceptible to migration caused by erosion during major storm events (CH2M HILL 2015).

4.2 Alternative 2: Cap and Vertical Barrier for the Upper Canal.

Alternative 2 includes placing a cap on the upper canal bottom to cover sediment from the north end down to the vehicle bridge, where a vertical sheet pile wall would be constructed across the canal to contain the cap and sediment. Downstream of the wall, the canal would not be affected. The cap would consist of a geomembrane placed directly on the sediments and fill to a thickness appropriate to support mangrove establishment and drainage.

Some maintenance would be required on the cap. It is expected that annual inspections would be performed to check the effectiveness of the containment components (cap and sheet pile, vegetation, erosion control). This would include visual inspections for damage caused by storms and repairs of such damage. A brief report would be produced for each inspection presenting observations, any problems noted, and recommended repairs/maintenance. No cap or erosion protection is required in the lower canal; current and wave erosive forces are mitigated by the depth of water and mangrove density.

To supplement these engineering controls, existing site and institutional controls would be continued/implemented to restrict access and intrusive activities. These include fencing, security, work permitting, and use and zoning restrictions. The owner is expected to retain title to the remediated lands to enforce and maintain controls (CH2M HILL 2015).

4.3 Alternative 3: Cap and Vertical Barrier for the Upper Canal and Long-Term Monitoring of the Lower Canal.

Alternative 3 is identical to Alternative 2 for the upper canal. Alternative 3 adds long-term monitoring of the lower canal surface sediment and benthic communities. Long-term monitoring would be performed to confirm the continued stability of the benthic community in the lower canal. This monitoring would be in addition to the periodic inspections and reviews of the upper canal cap and would include benthic infauna sampling and analysis in years 5, 15, and 25 after implementation of the remedy (CH2M HILL 2015).

5. Proposed Remedy

The recommended Alternative 2 consists of the following remedial components:

- Site controls and preparation, including stormwater management, turbidity controls, staging areas, and material sources.

- Mangrove removal from the active remedy area for access and installation of cap materials. Estimated area to be cleared is 1.4 acre based on a 20-foot-wide construction zone along the banks of the upper canal and a 50-foot by 50-foot access way.
- Mangrove root and branch disposal may be required depending on contact with impacted sediment. Mangrove roots, which have contacted sediment, will be disposed of. These issues will be addressed based on further characterization of the canal topography and mangrove removal processes.
- A permanent sheet pile wall installed across the canal at the vehicle bridge from bank to bank. Estimated sheet pile parameters: 80 feet long bank to bank and average depth of 12 feet (960 square feet [ft²]).
- An estimated 52,800 ft² of 40 mil high-density polyethylene (HDPE) geomembrane placed directly on the sediment of the upper canal followed by a layer of fill from 2 to 4 feet thick (estimated total in place volume, including additional fill caused by settlement, is 6,067 cubic yards [yd³]). Consolidation settlement does not occur all at once. Fill will be placed in thin lifts to facilitate controlled settlement; phased placement may be required to reach final grade. Approximately 5,067 yd³ of the fill will be caliche and 1,000 yd³ will be topsoil. Geomembrane will cover bank to bank, from the downstream sheet pile wall to upstream end of canal. Contouring of the fill will be performed to provide appropriate upland, wetland and aquatic habitats, drainage, erosion control, and cover of the membrane.
- Erosion control consisting of geotextile and armor stone in the swale within the filled/capped area and other erodible areas. Estimated erosion control parameters: 8,800 ft² of geotextile and 300 yd³ of stone in the upper canal and 500 ft² of geotextile and 74 yd³ of armor stone at the vertical wall.
- Mangrove propagation in the wetland and aquatic habitats formed by the new cover and in other disturbed areas; this includes follow-up inspection and restoration for permanent mangrove establishment. Inspections will confirm both the success of the propagation of the mangroves and the membrane resistance to root penetration. The estimated 1.35 acre of mangroves that will be cleared for construction plus an additional 0.3 acre of the cap area will be restored with mangroves and other wetland vegetation (total 1.65 acre). The remaining 0.7 acre of the total project area will include surface water, erosion protection, and natural vegetation areas.
- Periodic inspection and reporting to confirm performance and stability of these components.
- Site maintenance and institutional controls: fencing, security, and deed restrictions which would prohibit activities that could compromise the integrity of the containment/cap system that would apply to existing and future property owners.

6. Evaluation of Proposed Remedy

This section provides a description of the criteria used to evaluate the proposed remedy consistent with USEPA guidance, "Corrective Action for Releases from Solid Waste Management Units at Hazardous Waste Management Facilities; Proposed Rule," 61 Federal Register 19431, May 1, 1996 (USEPA 2003). The criteria are applied in two phases. In the first phase, the three decision threshold criteria are evaluated as general goals. In the second phase, those remedies that meet the threshold criteria are evaluated against the seven balancing criteria to determine which proposed remedy alternative provides the best relative combination of attributes. PTP LLC provided this evaluation in the October 2015 CMS and USEPA provided concurrence in a letter dated July 27, 2018.

6.1 Threshold Criteria

- 1) **Protect Human Health and the Environment** – Alternative 2, Cap and Vertical Barrier for the Upper Canal, is protective of the environment via a cap (membrane and fill material) over sediment in the upper canal; this isolates the dripolene-related constituents from benthic organisms. A vertical barrier prevents movement of contaminated sediment and cap material downstream of the remedy. The lower canal supports a diverse benthic community and requires no remediation. Human health is protected by institutional and site controls. The proposed remedy will continue to protect human health and the environment from exposure to contamination, including future risks. Land and groundwater use restrictions will prohibit future uses that would pose an unacceptable risk through

the use of an environmental covenant or other administrative mechanism. Capping and vertical barrier will prevent future exposure of underlying waste materials.

- 2) **Achieve Media Cleanup Objectives** – The proposed remedy meets the corrective action objectives appropriate for the expected current and reasonably anticipated future land use. The proposed remedy meets the non-numerical media cleanup goals by isolating sediments with elevated PAH concentrations that may adversely impact ecological receptors in the upper canal with a protective cap. The corrective action objectives and media cleanup goals will be met at the completion of corrective action construction.
- 3) **Control the Source of Releases** – Proposed remedies should seek to eliminate or reduce further releases of hazardous wastes or hazardous constituents that may pose a threat to human health and the environment. Releases occurred during the approximately seventy years the Facility used and maintained the Cooling Water Canal. Removal of the wastes are impractical and current controls, future controls, and the proposed remedy eliminate exposure, potential future releases and unacceptable risk.

6.2 Balancing/Evaluation Criteria

- 1) **Long-Term Reliability and Effectiveness** – The proposed remedy of containment will maintain protection of human health and the environment over time by controlling exposure to the hazardous constituents remaining in soils and groundwater. The membrane and fill cap provide positive isolation between the impacted sediment and receptors in the upper canal. Fill and cap materials are stable and reliable containment for a performance life of 30 years or more. Sediment and cap material at the downstream end of the upper canal are horizontally contained by a vertical barrier to prevent movement downstream. Administrative restrictions are expected to be effective in minimizing residual risk by preventing disturbance, erosion, and worker exposure to capped sediments in the upper canal and subsurface sediments in the lower canal during future industrial use.
- 2) **Reduction of Toxicity, Mobility, or Volume of Waste** – The proposed remedy is not designed to reduce the toxicity or volume of waste. Wastes were placed in the Cooling Water Canal beginning decades ago prior to environmental regulation and the objective of the remedy is to eliminate exposure and risk to human health and the environment, which it will. Sediments are not treated, but mobility of PAH constituents is significantly reduced in the upper canal.
- 3) **Short-Term Effectiveness** – The area around the PTPLLC is industrial with no nearby residents. Risks to community during construction include material truck deliveries. These risks would be minimized through implementation of a construction health and safety plan. Employing appropriate health and safety procedures and protective equipment will minimize risks to workers from exposure to constituents.
- 4) **Implementability** – The proposed remedy is readily implementable. Permits to construct the remedy will be required from USEPA, the United States Army Corps of Engineers, and the Commonwealth of Puerto Rico. It is anticipated that permitting efforts will be completed within the 2019 calendar year. Corrective action construction would likely take 4 to 6 months to implement. The capping technology and deployment equipment requires specialized worker skills and equipment. Sheet pile technology and deployment equipment are proven and readily available in Puerto Rico. Filling was tested in the treatability study.
- 5) **Cost** – The total cost for the proposed SWMU 5 remedy is estimated to be \$2,900,000, within a range of \$2,030,000 to \$4,350,000 (+50/-30) in 2019 dollars.
- 6) **Community Acceptance** – There have been no known conflicts within the community regarding the investigation and remediation efforts. Ultimately, community acceptance of the proposed remedy will be evaluated based on comments received during the public comment period and will be described in the Final Decision and Response to Comments.
- 7) **State/Support Agency Acceptance** – USEPA has reviewed and concurred with the proposed remedy for the Cooling Water Canal. Furthermore, USEPA has provided input and been involved throughout the investigation process.

7. Financial Assurance

PTPLLC will be required to demonstrate and maintain financial assurance for completion of the remedy pursuant to the standards contained in the USEPA regulations.

8. Public Participation

Interested persons are invited to comment on the proposed remedy for the CWC. The public comment period will last sixty (60) calendar days from the date that notice of the start of the comment period is published in a local newspaper. Comments may be submitted to Luis Negron by phone at (787) 977-5855 or email Negron.luis@epa.gov or at the mailing address listed below.

United States Environmental Protection Agency
Caribbean Environmental Protection Division
City View Plaza II Building, Suite 7000
#48 Road 165. KM 1.2
Guaynabo, PR 00968-8069

A public hearing will be held on October 10, 2019 at the

Hilton-Ponce Golf and Casino Resort
1150 Caribe Avenue
Ponce, Puerto Rico 00716
787-259-7676

Parking fees will be covered for individuals attending the public hearing.

The proposed remedy may be modified based on new information and/or public comments. Therefore, the public is encouraged to review the Administrative Record and to comment on the proposed remedy presented in this document. The Administrative Record contains all the information considered by USEPA for the proposed remedy at this Facility. The Administrative Record is available for review and can be found at the following location:

9. References

CH2M HILL. 2006. *Baseline Ecological Risk Assessment, Solid Waste Management Unit (SWMU) No. 5, Cooling Water Canal*. Peñuelas Technology Park LLC, Peñuelas, Puerto Rico. June

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CH2M HILL. 2014a. *Draft Benthic Study Report, Solid Waste Management Unit (SWMU) No. 5 Cooling Water Canal*. April.

CH2M HILL. 2015. *Corrective Measures Study (CMS) Work Plan for Cooling Water Canal (SWMU) No. 5*. Peñuelas Technology Park LLC Peñuelas, Puerto Rico. October.

Union Carbide Corporation (UCC). 2000. Phase I RCRA Facility Investigation (RFI) Report for Group III SWMUs. January 28.

Union Carbide Corporation (UCC). 2001. Phase II RCRA Facility Investigation (RFI) Report - Group III SWMUs; RFI Report – Group IV SWMUs. July.

U.S. Environmental Protection Agency (USEPA). 2003. *Final RCRA Hazardous Waste Operational and Post-Closure Care Permit*.

Figures



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CH2MHILL

Figure 1. Facility Location Map
 SWMU No. 5 (CWC)
 PTPLLC, Peñuelas, Puerto Rico

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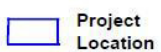
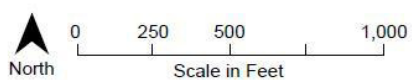


FIGURE 2
Project Location
SWMU No. 5 (CWC)
PTPLLC, Peñuelas, Puerto Rico

CH2MHILL.

Figure 2. Project Location
SWMU No. 5 (CWC)
PTPLLC, Peñuelas, Puerto Rico